RECORD OF DECISION AMENDMENT

INTEL SANTA CLARA 3
SUPERFUND SITE

U.S. Environmental Protection Agency
Region 9
San Francisco, CA

EPA ID: CAT000612184

September 2010

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PART 1: DECLARATION FOR THE RECORD OF DECISION AMENDMENT

A. Site Name and Location

Intel Corp., Santa Clara III (Intel Santa Clara 3)
3880 Northwestern Parkway
Santa Clara, California
CERCLIS Identification No. CAT000612184

B. Statement of Basis and Purpose

This decision document presents the revised remedy for the Intel Santa Clara 3 Site, in Santa Clara, California, which was chosen in accordance with the Comprehensive Environmental Response Compensation and Liability Act (CERCLA) as amended, and, to the extent practicable, the National Contingency Plan (NCP). This decision, which amends the 1990 Record of Decision, is based on the Administrative Record file for this site. The State of California concurs with the selected remedy.

C. Assessment of Site

The response action selected in the 1990 Record of Decision, as modified by this ROD Amendment, is necessary to protect the public health or welfare or the environment from actual or threatened releases of hazardous substances into the environment. The remedy selected in 1990 successfully removed most of the contaminant mass at the site, but is no longer in operation and contamination remains above cleanup standards, and so an amendment to the ROD is necessary.

D. Description of the Revised Remedy

The main components of the original 1990 remedy included:

- Groundwater pumping from extraction wells
- Treatment of the contaminated water with granular activated carbon and discharge of the treated water to surface water pursuant to an NPDES permit
- A pulsed pumping trial to evaluate the efficacy of intermittent pumping to remove residual contamination
- Groundwater monitoring
- A deed restriction to prevent exposure to the contaminated groundwater until cleanup levels are achieved.

This ROD Amendment includes the following components of the original remedy:

- The deed restriction already recorded for the site
- The groundwater monitoring program currently in place at the site.

The revised remedy replaces the other components of the original remedy (pumping, treating, discharging, and intermittent pumping) with:

- Monitored Natural Attenuation (MNA)

E. Statutory Determinations

The revised remedy is protective of human health and the environment, complies with Federal and State requirements that are applicable or relevant and appropriate to the remedial action, is cost-effective, and utilizes permanent solutions and alternative treatment (or resource recovery) technologies to the maximum extent practicable. The revised remedy does not satisfy the statutory preference for treatment as a principal element of the remedy, because most of the contaminant mass was already removed and treated by the original remedy, and no principal threat wastes are present at the site.

Because this remedy will result in hazardous substances, pollutants, or contaminants remaining on-site above levels that allow for unlimited use and unrestricted exposure, the statutory review cycle triggered by the original remedial action will continue to ensure that the remedy is protective of human health and the environment. The next Five Year Review for the site is required in 2011.

F. ROD Data Certification Checklist

The following information is included in the Decision Summary section of this Record of Decision. Additional information can be found in the Administrative Record file for this site.

- Chemicals of concern and their respective concentrations (p. 7)
- Baseline risk represented by the chemicals of concern (p. 7)
- Cleanup levels established for chemicals of concern and the basis for these levels (p. 9)
- How source materials constituting principal threats are addressed (p. 14)
- Current and reasonably anticipated future land use assumptions and current and potential future beneficial uses of ground water used in the baseline risk assessment and ROD (p.7)
- Potential land and ground-water use that will be available at the site as a result of the Selected Remedy (p. 15)
- Estimated capital, annual operation and maintenance (O&M), and total present worth costs, discount rate, and the number of years over which the remedy cost estimates are projected (p. 25)
- Key factor(s) that led to selecting the remedy (i.e., describe how the Selected Remedy provides the best balance of tradeoffs with respect to the balancing and modifying criteria, highlighting criteria key to the decision) (p. 14)

G. Authorizing Signature

Kathleen Salyer, Assistant Director
Superfund Division
CA Site Cleanup Branch
U.S. Environmental Protection Agency, Region 9

9/7/10
Date

PART 2: DECISION SUMMARY

A. Site Name, Location, and Brief Description

The Intel Santa Clara 3 Site (Site) is located at 2880 Northwestern Parkway, Santa Clara, California (Figure 1). The Site is approximately one acre in size, and consists of a low-rise building, and landscaping and parking areas. The groundwater beneath the Site is contaminated with volatile organic compounds (VOCs), including trichloroethylene (TCE) which is a solvent. The responsible party is financing and performing the remedial action. EPA has been the lead regulatory agency at the site since 2006, and the Regional Water Quality Control Board of the State of California is the support agency. The CERCLIS Identification Number is CAT000612184.

B. Site History and Enforcement Activities

The buildings at the Site were constructed in 1975 by Intel Corporation and were used from 1976 to 2008 for performing quality control of chemicals and electrical testing of semiconductors. Groundwater contamination was first discovered at the Site in 1982, when groundwater samples were collected as part of a leak detection program for underground tanks in the Bay Area initiated by the Water Board. Intel Corporation, the responsible party, has been conducting and financing all response activities under several EPA and Water Board orders.

Groundwater extraction and treatment began in 1985, and EPA added the site to the National Priorities List (NPL) in 1986. The Remedial Investigation/Feasibility Study (RI/FS) was completed in 1990. The Remedial Action Plan as set forth in Regional Water Quality Control Board Order No. 90-105, the Final Site Cleanup Requirements, was adopted on July 18, 1990. EPA signed the original Record of Decision for the site on September 20, 1990. The Regional Water Quality Control Board acted as the lead agency for oversight of the implementation of the remedy until 2006. The selected remedy for the Site was pumping the contaminated groundwater and treating it with activated carbon to remove contaminants before discharging to a storm drain. The remedy also included installation of an additional extraction well, a plan for intermittent pumping to improve the efficiency of the remedy, groundwater monitoring, and the recording of a land use covenant prohibiting the use of shallow groundwater.

The third extraction well was added in 1990. In 1991, the cyclic pumping trial specified by the ROD was begun because the efficiency of the system at removing contamination was declining. Though VOC concentrations continued to decline, no significant increase in overall contaminant removal was obtained by changing the pumping scheme (Figure 2). In 1994 the groundwater extraction and treatment system had been operating for about nine years, and had treated approximately 45 million gallons of groundwater, removing about 28 pounds of TCE. Because the system had removed most of the contaminant mass and was no longer removing significant levels of contaminants, the Regional Water Quality Control Board approved the cessation of groundwater extraction and allowed Intel to implement a trial monitored natural attenuation (MNA) program. EPA assumed oversight of the Intel Santa Clara 3 Site in 2006.

C. Community Participation

The Proposed Plan for the ROD amendment for the Intel Santa Clara 3 site was released on May 5, 2010. An announcement was posted in the *Santa Clara Weekly* on May 5, 2010, and a mailing was sent to about 300 recipients within ½ mile of the site. The public comment period lasted from May 5, 2010 to June 4, 2010, and a public meeting was held on May 19, 2010 at the Santa Clara Public Library, 2635 Homestead Road, Santa Clara California. No comments were received during the public comment period.

D. Scope and Role of Response Action

The response action presented in this amendment to the ROD is a follow-up to the original remedy, which was successful at removing most of the contaminant mass in the groundwater. This ROD amendment addresses the entire site, which consists of contamination of the groundwater aquifer. The response action does not address soils because investigations have not demonstrated that soils contain contaminants at levels of concern. The selected remedy replaces part of the existing remedy, which was a groundwater extraction and treatment system that was turned off in 1994. As discussed later in this decision document, groundwater monitoring data collected over recent years demonstrated decreasing levels of contamination in the groundwater. The new remedy, monitored natural attenuation, addresses the remaining TCE contamination that exceeds the cleanup goals.

E. Site Characteristics

Physical Characteristics

The Site is approximately one acre in size and is located at 2880 Northwestern Parkway in the City of Santa Clara, California (Figure 1). The Site consists of a low-rise building and landscaping and parking areas. The City of Santa Clara has a population of 95,200, and is part of the San Francisco Bay Metropolitan Region which has a population of about six million. The Site is located in a light industrial and commercial area, known as Silicon Valley, which is dominated by the electronics industry. Most buildings in the area are low rise developments containing office space and research and development facilities.

Hydrogeology

Groundwater flows to the northeast towards San Francisco Bay (Figure 3). The Site is located in the Santa Clara Valley, a structural basin filled with marine and alluvial sediments. The geology beneath the Site is a complex heterogeneous sequence of interbedded sands, silts, and clays. Municipal water supply wells tap an extensive deep regional confined aquifer that lies generally greater than 200 to 300 feet below ground surface (bgs). A thick, relatively impermeable aquitard separates this deep confined aquifer from a complex series of discontinuous aquifers and aquitards that can extend up to within a few feet of the ground surface. Two distinct water-bearing zones have been investigated at the Site. The uppermost water-bearing zone, called the A-zone, is found from 10 feet bgs to 25 feet bgs. The next lower water-bearing zone, the B-zone, is found from about 30 to 45 feet bgs. The two zones are separated by a four to ten foot thick aquitard composed of a clayey layer, though there could be some hydraulic connection between the two zones due to the discontinuous nature of the sediment types. The nearest municipal water supply well downgradient of the Site is the City of Santa Clara Well No. 33 located 1.6 miles north of the Site. The nearest residences are approximately 1800 feet south of the site and 7200 feet north-northeast of the site.

Remedial Investigation

Groundwater contamination was first discovered at the Site in 1982 when groundwater samples were collected at the Site as part of a leak detection program for underground tanks initiated by the Regional Board in the South Bay Area. Following the discovery of groundwater contamination at the Site, the Regional Water Quality Control Board required Intel to perform a soil and groundwater investigation. The remedial investigation included groundwater monitoring in the A-zone and B-zone, soil sampling, and soil vapor sampling. The source of contamination was never positively identified. Three potential sources were proposed and, to the extent practical, evaluated. The potential sources were: 1) leaks from the acid waste neutralization area; 2) spills near the above ground solvent storage facility; and 3) solvent spills associated with cleaning out pipes put in place during construction of the facility. As part of the investigations, an acid waste neutralization sump was removed. Data collected during the evaluation of these potential sources indicated that it was unlikely that a source existed which could contribute to the existing VOC pollution in groundwater. Further details are provided in the RI/FS and the original ROD, which are included in the Administrative Record. In 2006, Intel conducted a Focused Feasibility Study to evaluate remedial alternatives that might accelerate the reduction of the remaining TCE to achieve cleanup standards, and conducted a pilot test of chemical oxidation in 2007.

Extent of Contamination

Groundwater contamination at the site is confined to the A-zone, in an area approximately 300 feet by 150 feet across (Figure 3). The contaminants found in groundwater at the Site during the initial investigation included trichloroethylene (TCE); 1,1,1-trichloroethane (1,1,1- TCA); 1,1-dichloroethylene (1,1.DCE); 1,1-dichloroethane (1,1-DCA); l,2-dichloroethane (1,2-DCA); cis 1,2-dichloroethylene (cis 1,2-DCE); trans 1,2-dichloroethylene (trans 1,2-DCE); Freon 113; and Freon 11. Currently, only TCE is present above cleanup standards, and most of the other chemicals are not detectable above laboratory reporting limits. Table 1 provides the Contaminants of Concern with their respective maximum historical concentrations and maximum present concentrations. The past several years of groundwater monitoring results for the three wells that still have detectable concentrations of TCE are shown in Figures 5, 6, and 7.

TABLE 1: Contaminants of Concern, with A-zone concentrations		
Chemical	Maximum Historical Concentration (1982-89)	Maximum 2010 concentration
1,1 DCA	8.2	ND[a]
1,2 DCA	16	ND
1,1 DCE	84	ND
cis-1,2-DCE	<7.9[b]	0.7
trans-1,2-DCE	<7.9[b]	ND
1,1,1-TCA	810	ND
TCE	490	11
Freon 113	1300	2.2
Freon 11	2.8	ND
[a] *<0.5 ug/L*		
[b] *reported as total 1,2-DCE*		

The soil and soil vapor analyses did not indicate significant contamination of site soils. In 1984, the only VOC detected in soil was TCE, at a maximum concentration of 0.048 milligrams per kilogram (mg/kg). This is well below the EPA Region 9 Regional Screening Levels (RSLs) for direct exposure to TCE in soil of 2.8 mg/kg for residential use and 14 mg/kg for industrial use.

F. Current and Potential Future Site and Resource Use

The land use at the site is currently commercial/light industrial. Intel used the site from 1976 to 2008 for performing quality control of chemicals and electrical testing of semiconductors. The building at the site was unoccupied from 2008 until mid-2010, when the property was purchased by Siren Data Corp. The surrounding land use is also commercial/light industrial, and is dominated by the electronics industry. The land use at the Intel Santa Clara 3 site is expected to remain commercial/light industrial because of the surrounding land use patterns and because the deed restriction recorded for the site prohibits residential use of the property.

The State of California has designated the groundwater beneath the site as a potential drinking water source. The Site overlies the Santa Clara Valley groundwater basin, which provides up to 50% of the municipal drinking water for over 1.4 million residents of the Santa Clara Valley. However, the contamination at the Site has only affected the groundwater in the shallowest water-bearing zone, which is not currently used for drinking. Naturally occurring selenium and total dissolved solids make the shallow water unsuitable for drinking without treatment. Due to these characteristics of the shallow groundwater, and the land use covenant in place at the site that restricts the access or use of the groundwater, the shallow groundwater is not reasonably anticipated to be used as a drinking water source.

G. Summary of Site Risks

A Preliminary Health Assessment for the site was prepared by the Agency for Toxic Substances and Diseases Registry, U.S. Public Health Services, in January 19, 1989. The report stated that the site was not considered to be a current public health concern because of the apparent absence of human exposure to hazardous substances. The Water Board conducted a risk assessment for hypothetical exposure to the 1989 levels of contamination in groundwater in the A-zone. The carcinogenic risk and hazard index associated with drinking and showering with the contaminated groundwater were calculated at $7x10^{-5}$ and 0.001 respectively. As such, the carcinogenic risk was within EPA's acceptable risk range of one-in-a-million (10^{-6}) to one-in-ten-thousand (10^{-4}) individual lifetime excess cancers that may develop in a population, and the hazard index was less than 1. However, the concentration of TCE exceeded applicable or relevant and appropriate requirements (ARARs), which are discussed in subsequent sections. Because ARARs drove the cleanup at the site, not carcinogenic risk, a new risk assessment was not conducted as part of this ROD amendment.

There are no complete exposure pathways currently threatening human health or the environment at the Site. The reasonably anticipated future land use at the Site is light industrial, based on past activity at the Site and surrounding land use. A land use covenant recorded with the Santa Clara County Recorder's Office in 2008 prohibits residential and certain other land uses at the Site. The land use covenant also prohibits groundwater extraction and use or soil excavation without express permission from the Water Board.

The property is mostly paved, and potential impacts to surface waters are not a concern as there are no natural surface drainage features or surface water bodies at the Site. The nearest surface water body is San Tomas Aquino Creek, located ½ mile west of the site. Contamination at the Site does not pose a risk to critical habitats or endangered species because there are no likely exposure pathways. No parks or surface water are adjacent to the site, and over 90% of the property is covered with blacktop or a building slab. Chemical constituents are only present in the shallow groundwater. Therefore, the RI/FS concluded that there is no probable pathway for exposure to critical habitats or endangered species.

Vapor intrusion, where pollutants volatilize from the groundwater and migrate into the air inside nearby buildings, was evaluated as a possible way for humans to be exposed to the contamination, which is an exposure pathway that was not considered in the original ROD. Indoor air monitoring results from March 2010 did not detect the presence of any VOCs above the EPA Region 9 Regional Screening Levels (RSLs). The one detection of TCE at 1.8 $\mu g/m^3$ was below the RSL of 6.1 $\mu g/m^3$ for industrial indoor air, and the one detection of vinyl chloride at 0.076 $\mu g/m^3$ was below the RSL of 2.8 $\mu g/m^3$. The low concentrations of TCE in the groundwater and soil gas also indicate there is no significant risk from vapor intrusion at the Site.

As summarized here, the risks currently posed by contamination at the Site are low and mostly controlled. However, the pump and treat remedy selected in 1990 is no longer functioning as intended, and the remedy must therefore be amended to accurately reflect conditions at the Site.

H. Remedial Action Objectives

The Remedial Action Objectives in the original ROD are to prevent migration of contaminants in the groundwater, prevent any future exposure to the public of contaminated groundwater, and to restore the A-zone groundwater to drinking water quality. These are also the objectives of this revised remedy, although the only outstanding RAO is the restoration of A-zone groundwater to drinking water quality. Annual groundwater monitoring has indicated that the contaminated groundwater is not moving offsite, and the deed restriction in place at the site is effectively preventing exposure to the contaminated groundwater.

Table 2 provides the cleanup standards from the ROD for all the chemicals initially detected. At the time, these levels were chosen based on proposed or adopted MCLs.

TABLE 2: Groundwater Cleanup Standards	
Chemical	**Cleanup Standard (ug/L)**
1,1-dichloroethane (1,1-DCA)	5
1,2-dichloroethane (1,2-DCA)	0.5
cis-1,2-dichloroethene (cis-1,2-DCE)	6
trans-1,2-dichloroethene (trans-1,2-DCE)	10
1,1dichloroethene (1,1-DCE)	6
Freon 113	1200
Freon 11	150
1,1,1-trichloroethane (1,1,1-TCA)	200
trichloroethene (TCE)	5

From the many VOCs detected initially, TCE is the only contaminant at the Site that remains at levels above its MCL, which is 5 µg/L.

I. Description of Alternatives

EPA evaluated five alternatives for the revised remedy at the Intel Santa Clara 3 Site:

Alternative 1: No Action
Alternative 2: In-situ Enhanced Bioremediation
Alternative 3: In-situ Thermal Desorption
Alternative 4: In-situ Chemical Oxidation
Alternative 5: Monitored Natural Attenuation

Alternative 1: No Action

EPA is required to consider the no action alternative. Under this alternative, the existing land use covenant would remain in place, no additional treatment would be implemented, and monitoring would cease.

Alternative 2: In-situ Enhanced Bioremediation

In-situ bioremediation relies on microorganisms, either naturally occurring or artificially introduced into the subsurface, to break down the contaminants to inert and less toxic by-products. Enhanced bioremediation includes the injection of organic substrates into the subsurface to promote the biotransformation. Bioremediation can occur aerobically (in the presence of oxygen) or anaerobically (without oxygen), but aerobic bioremediation was screened out because of the difficulty of circulating methane, oxygen, and nutrients through the subsurface given the physical site constraints of buildings and utility lines. In the anaerobic process that was evaluated as an alternative for the Site, microorganisms utilize the injected compounds to chemically convert VOC's such as TCE to intermediate byproducts, and then eventually to non-toxic ethene. The amount of time required to achieve the MCL with this technology is uncertain, and may be a few years to a few decades. In-situ bioremediation is estimated to cost $120,000 in capital cost, with annual operation and maintenance costs of $15,000 for monitoring. The estimated present value cost of Alternative 2 is about $290,000.

Alternative 3: In-situ thermal desorption

In-situ thermal desorption (ISTD) heats the soil in the treatment zone to volatilize contaminants (turn liquid/dissolved TCE into a gas) so they can be collected with a soil vapor extraction system. Individual heating elements reach temperatures of 1,000-1,500°F, and are generally spaced 10 to 20 feet apart. The well field is designed such that the areas heated by each element overlap to maintain the minimum temperature required to volatilize the TCE throughout the target area. The system would operate for a few months to a year, followed by monitoring to determine effectiveness. Disadvantages of implementing ISTD at the site include interference with and endangerment of subsurface piping, as well as high energy cost. The capital cost for ISTD is estimated at $280,000, with $15,000 of annual monitoring costs for about 10 years. The present value cost of Alternative 3 is about $360,000.

Alternative 4: In-situ chemical oxidation

This alternative uses oxidation, which is a chemical reaction involving electron transfer, to chemically convert contaminants into non-hazardous or less toxic compounds that are more stable, less mobile, or non-reactive. Chemical oxidation breaks TCE down to carbon dioxide and water. In-situ oxidation would require the injection of oxidants (chemicals that induce the reaction), such as Fenton's Reagent, hydrogen peroxide, or permanganate, into the ground so that they can react with and destroy the contaminants in the groundwater. A pilot test of oxidant injection was conducted by Intel in 2006. TCE concentrations initially decreased, but rebounded and did not decrease below the MCL (Figures 5-7). Because multiple injections of oxidant will be required, the exact amount of time required to achieve the MCL with this technology is uncertain, but will be a few years to a few decades. In-situ chemical oxidation is estimated to cost $140,000, with annual operation and maintenance costs of $15,000 in monitoring. The present value cost of Alternative 4 is about $300,000.

Alternative 5: Monitored Natural Attenuation (EPA's Preferred Alternative)

Natural attenuation relies on naturally occurring physical, chemical, or biological processes that act without human intervention to reduce the mass, toxicity, mobility, volume, or concentration of contaminants in soil or groundwater. A study investigating the suitability of natural attenuation for the Site was conducted in 2009. Lines of evidence show that TCE concentrations are decreasing through physical, not biological, processes. Based on the most recent five years of monitoring data, the two remaining wells with TCE concentrations above the MCL are projected to take 5 to 35 years to reach the MCL. Depending upon the model and data set used, estimates range from a few years to several decades, so an exact prediction of the time required to reach the MCL in all wells is not possible. There is no capital cost associated with MNA because the monitoring wells have already been constructed, but the monitoring costs of about $20,000 a year add up to a present value cost of about $230,000.

Common Elements and Distinguishing Features

Each of the five remedy alternatives addresses the remaining groundwater contamination at the site. All alternatives include the existing deed restriction recorded for the site, which prevents exposure to the contaminated groundwater. All alternatives except for Alternative 1, No Action, include groundwater monitoring. The key distinguishing feature of the alternatives is the treatment technology employed to reduce the remaining TCE concentration below the MCL. Alternative 1 takes no further action to address the TCE in the groundwater. Alternatives 2, 3, and 4 use active in-situ technologies, which are bioremediation, thermal desorption, and chemical oxidation, respectively. Alternative 5 relies on passive reduction of TCE concentrations through naturally occurring processes. Other distinguishing features related to nine criteria that EPA uses to evaluate remedial alternatives are discussed in the Comparative Analysis section.

Expected Outcomes of Each Alternative

The expected outcome of Alternatives 2, 3, 4, and 5 is the reduction of TCE concentrations in the shallow groundwater below the MCL. Alternative 1, because it does not include further monitoring, would not be expected to demonstrate that a reduction of TCE below the MCL has been achieved. The timeframe to achieve the remedial objectives varies depending upon the alternative, and there is considerable uncertainty in the estimates of the time to achieve the MCL.

J. Comparative Analysis of Alternatives

EPA evaluates each of the alternatives based on nine standard criteria. The two threshold criteria are the most important: overall protection of human health and the environment, and compliance with federal and state "applicable or relevant and appropriate requirements" (ARARs). Balancing criteria include long-term effectiveness and permanence; reductions in toxicity, mobility, and volume through treatment; short-term effectiveness; implementability and cost. Modifying criteria are state and community acceptance, which will be evaluated after the close of the public comment period. Figure 8 illustrates how each alternative compares to the nine criteria.

Threshold Criteria

Overall protection of human health and the environment

All of the alternatives will be protective of human health and the environment. The plume is not migrating, and there are no exposure pathways that might harm environmental receptors. Alternatives 2-5 will reduce TCE concentrations in the groundwater to below the MCL, which is considered protective of human health. The land use covenant already in place that restricts soil excavation and groundwater use currently prevents exposure to the TCE contamination in the groundwater.

Compliance with ARARs
ARARs can be chemical specific, action specific, or location specific. The MCL for TCE of 5 μg/L is a relevant and appropriate chemical-specific requirement. Alternative 1 does not comply with ARARs because it would leave concentrations of TCE at the Site above the MCL. Because Alternative 1 does not meet this threshold criterion, it was not analyzed further. Alternatives 2-5 will reduce the TCE concentrations below the MCL, and will thus comply with ARARs.

Balancing Criteria

Long-term effectiveness and permanence
The remediation achieved by Alternatives 2-5 would be permanent. Successful implementation of any of these alternatives would clean up the groundwater to drinking water standards, and continued monitoring would ensure that the reduction in concentrations is not temporary. The land use covenant already recorded for the Site restricts soil disturbance and groundwater use at the Site, which further assures permanent long-term protectiveness. In terms of long-term effectiveness, however, Alternative 4 would likely require multiple iterations of oxidant injection to achieve MCLs, since the contaminant is tightly bound to the soil. It is uncertain whether even multiple injections would reduce concentrations below MCL's, so natural attenuation might be required, in addition to in-situ chemical oxidation to achieve remedial action objectives. Therefore, the long-term effectiveness of this technology alone is uncertain. Similarly, the long-term effectiveness of Alternative 2 is uncertain because the lack of naturally occurring biological degradation indicates that conditions may be unsuitable for bioremediation. Furthermore, the pathway from TCE to harmless byproducts sometimes stalls at intermediate byproducts, and so once the TCE concentration is reduced, other contaminants could then require additional remediation. Alternatives 3 and 5 are expected to be effective in the long-term without the use of additional technologies.

Reduction in toxicity, mobility, or volume through treatment
Alternative 2 generates intermediate byproducts that are more toxic than TCE, such as vinyl chloride, but the end products of complete bioremediation will be nontoxic, so Alternative 2 reduces toxicity through treatment. Alternative 3 would remove TCE from the groundwater and then treat the collected TCE vapors at the surface, satisfying the preference for treatment. Similarly, Alternative 4 would satisfy the preference for treatment by destroying TCE using chemical oxidation and converting it into benign byproducts, such as carbon dioxide and water. Alternative 5 is not an active treatment for the purposes of this criterion, and thus ranks lower than other alternatives, but most of the contaminant mass was already removed and treated as part of the original remedy for the Site.

Short-term effectiveness
One aspect of short-term effectiveness is protection of community and workers during implementation of the remedy. Alternatives 2, 3, and 4 all pose some risk to the workers implementing the remedy, due to the presence of high temperatures, heavy machinery, and/or strong chemicals. However, by following health and safety protocols these risks can be managed. Alternative 5, monitored natural attenuation, poses the least risk to workers or the community during implementation. Another aspect of short-term effectiveness is the amount of time required to achieve the remediation goals. Alternative 3 would take the least time relative

to the other technologies. The time required to achieve remediation goals is more uncertain for Alternatives 2, 4, and 5, and so this aspect of the short-term effectiveness criterion is not a strong distinguishing factor between these alternatives.

Implementability

Alternative 3 has low technical feasibility due to interference with subsurface gas and electric utility lines at the Site. Additionally, the high temperatures generated by the technology are incompatible with the PVC monitoring wells onsite, which would have to be replaced. Therefore, Alternative 3 has very low implementability. Alternative 2 has moderate implementability, due to the difficulty of sustaining biological reactions with low levels of contaminants, and because biological degradation does not appear to be naturally occurring at the Site. There are also challenges associated with evenly distributing the compounds designed to enhance bioremediation throughout the subsurface, due to the clay properties of the soil and obstructions from utility lines and buildings. Alternative 4 has similar challenges related to getting the injected chemicals in contact with the contaminants to create the oxidation reaction. Alternative 5 is the most implementable at the site, since additional subsurface structures are not needed.

Cost

EPA compares each alternative based on upfront capital cost, annual operation and maintenance cost, and overall present value cost, which is a measure of the total future project cost over a 30 year timeframe. Alternatives 2, 3 and 4 have significant upfront costs because of the onsite work required. Alternative 3 has the highest capital cost of $280,000, followed by Alternative 4 at $140,000, and Alternative 2 at $120,000. Alternative 5 has no upfront capital cost. Operation and maintenance costs for all the alternatives are similar, because the main annual expense is monitoring. Alternative 5 has a slightly higher operation and maintenance cost than the other alternatives, because monitoring for natural attenuation requires additional analyses beyond just TCE concentrations. In terms of present value costs, the most expensive technology is Alternative 3, estimated to cost $360,000. The next most expensive alternatives have very similar present value costs, of $300,000 for Alternative 4 and $290,000 for Alternative 2. Given the uncertainty in the number of injections and the amount of monitoring that will be required, these two costs are comparable. Alternative 5 is the least expensive, with an estimated present value cost of $230,000.

Modifying Criteria

State Acceptance

Staff of the Regional Water Quality Control Board, San Francisco Region, concur with EPA's proposed plan.

Community Acceptance

Community members did not provide comments on the proposed plan at the public meeting or submit written comments during the public comment period. Since there were no objections raised regarding the proposed amendment to the remedy, EPA assumes that amending the remedy is acceptable to the community.

K. Principal Threat Waste

The NCP establishes an expectation that EPA will use treatment to address the principal threats posed by a site wherever practicable. The principal threat concept is applied to the characterization of source materials at a Superfund site. Contaminated groundwater generally is not considered to be a source material, thus no principal threat waste exists at the Intel Santa Clara 3 site.

L. Selected Remedy

Based on information currently available, the EPA believes the selected remedy meets the threshold criteria and provides the best balance of tradeoffs among the other alternatives with respect to the balancing and modifying criteria. The EPA expects the selected remedy to satisfy the following statutory requirements of CERCLA §121(b): (1) be protective of human health and the environment; (2) comply with ARARs (or justify a waiver); (3) be cost-effective; (4) utilize permanent solutions and alternative treatment technologies or resource recovery technologies to the maximum extent practicable; and (5) satisfy the preference for treatment as a principal element, or explain why the preference for treatment will not be met.

EPA's preferred alternative is Alternative 5, Monitored Natural Attenuation, which will protect human health and the environment and achieve ARAR's. Though significant biological degradation does not appear to be occurring, other physical and chemical processes have been reducing contaminant concentrations since the pump and treat system was turned off. At Intel Santa Clara 3, the level of TCE in one of the three monitoring wells that still has detections of TCE is already below the MCL, and the remaining two wells with detectable TCE concentrations are gradually approaching the MCL of 5 μg/L. Though it may take several years or decades to reach the MCL, the alternative is still effective in the short term because there are no complete exposure pathways at the Site, the plume is not migrating, and the land use covenant currently in place prevents the groundwater from being accessed or used for any purpose. Even though Alternative 5 does not satisfy the preference for treatment, the original remedy already removed and treated most of the contaminant mass at the Site, and there are no principal threat wastes at the Site. Due to the low residual contaminant concentrations, the more active in-situ technologies would have significantly higher capital costs with limited value in risk reduction.

Monitored natural attenuation will rely on naturally occurring physical, chemical, or biological processes that act without human intervention to reduce the mass, toxicity, mobility, volume, or concentration of contaminants in soil or groundwater. Three wells at the site still have detectable concentrations of TCE, though only two wells have TCE still above the MCL. The concentrations have been declining, though not linearly (Figures 5-7). The most recent monitoring event detected TCE at 11 μg/L in well SC3-7A, 7.1 μg/L in SC3-3, and 3.1 μg/L in SC3-1. Depending upon the model and data set used, estimates for the time to reach the MCL range from a few years to several decades, so an exact prediction of the time required to reach the MCL in all wells is not possible. The land use covenant recorded in 2008 will remain in place for the site, and the annual groundwater monitoring program will continue. There is no capital cost associated with MNA, but the monitoring costs of about $20,000 a year add up to a present value cost of about $230,000 over a 30 year time horizon.

The expected outcome of the remedy is the restoration of the shallowest groundwater at the site to the quality required by its State-designated beneficial use as a potential source of drinking water. Specifically, TCE concentrations in the A-zone are expected to decrease below the MCLs within a few years or a few decades. The current land use of light industrial will not be affected by this revision of the remedy.

M. Statutory Determinations

Under CERCLA §121 and the NCP, the lead agency must select remedies that are protective of human health and the environment, comply with applicable or relevant and appropriate requirements (unless a statutory waiver is justified), are cost-effective, and utilize permanent solutions and alternative treatment technologies or resource recovery technologies to the maximum extent practicable. In addition, CERCLA includes a preference for remedies that employ treatment that permanently and significantly reduces the volume, toxicity, or mobility of hazardous wastes as a principal element and a bias against off-site disposal of untreated wastes.

This revision to the remedy is protective of human health and the environment. It is expected to achieve the remedial action objective of returning the contaminated groundwater to drinking water quality. Until this goal is achieved, a land use covenant already recorded for the site will remain in place to ensure that there are no exposure pathways to the contaminated groundwater.

This amendment to the remedy complies with all applicable or relevant and appropriate requirements identified for the site. From the ARARs identified during the original ROD, the only ARAR that still applies are the MCLs. The other requirements were complied with during the construction and/or operation of the original remedy but are no longer applicable or relevant and appropriate. The MCL for TCE is relevant and appropriate because the state of California has designated the groundwater at the site as a potential drinking water aquifer, and the chosen remedy is expected to reduce the concentration of TCE below the MCL and will therefore comply with ARARs.

This revision to the original remedy is cost-effective. The other remedial alternatives, including in-situ bioremediation, in-situ chemical oxidation, and in-situ thermal desorption, are more expensive with limited benefit in risk reduction because there are currently no exposure pathways to the contaminated groundwater. While monitored natural attenuation is more expensive than no action due to the long-term groundwater monitoring component of the remedy, the monitoring program is necessary to comply with ARARs by enabling a future determination that MCLs have been achieved.

The reductions in TCE concentrations achieved by this revision to the remedy are expected to be permanent and the remedy uses alternative or resource recovery technologies. While monitored natural attenuation is not a technology per se, it is an alternative remedy to the energy intensive pump and treat system that was part of the original remedy.

Monitored natural attenuation does not satisfy the preference for treatment as a principal element, but this preference applies to principal threat wastes, and no principal threat wastes are present at the site. Furthermore, the original remedy, which included treatment as a principal element, already removed and treated most of the contaminant mass at the site. Therefore, because this amendment is a follow-up remedy to address residual contamination, choosing a remedy without active treatment is acceptable.

NCP §300.430(f)(4)(ii) requires a five-year review if the remedial action results in hazardous substances, pollutants, or contaminants remaining on-site above levels that allow for unlimited use and unrestricted exposure. TCE concentrations in the groundwater are still above levels that allow for unlimited use and unrestricted exposure, and so the statutory five year review requirement triggered by the original remedial action will remain in place for the site. Three five year reviews (1995, 2001, and 2006) have been completed for the site since the original ROD was signed. The next five year review will be conducted in 2011.

N. Documentation of Significant Changes

No objections to the proposed revision to the remedy were received, and so this remedy selected in this ROD amendment does not differ significantly from the Proposed Plan made available in May 2010.

PART 3: REPONSIVENESS SUMMARY

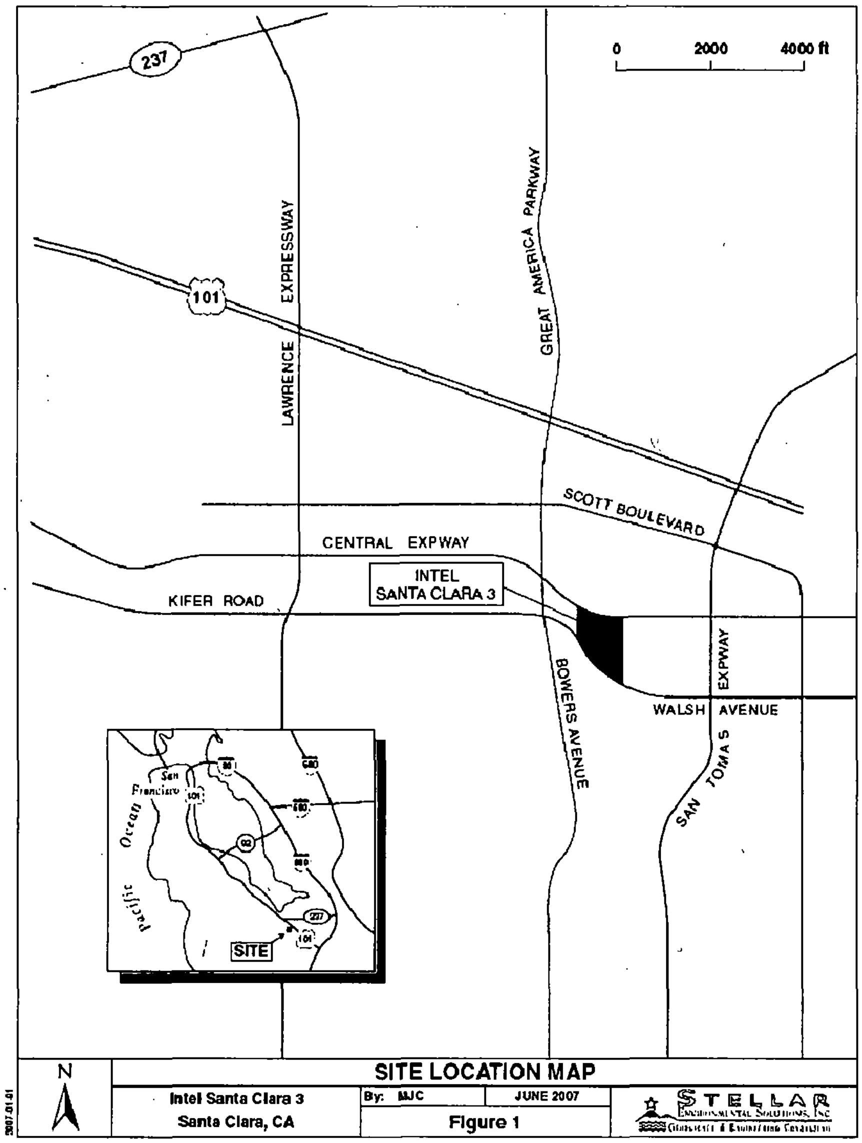
EPA did not receive any substantive comments on the Proposed Plan to amend the ROD during the public comment period, and therefore there is no response to comments included as part of this amendment to the ROD. Intel Corporation, the responsible party, previously submitted a report in 1996 entitled Request for Fundamental Change to Record of Decision: Remediation by Natural Attenuation, and continues to support monitored natural attenuation as an appropriate remedial alternative.

A. Stakeholder Comments and Lead Agency Responses

The California Regional Water Quality Control Board, San Francisco Region, concurs with EPA's selected remedy. There were no objections raised by the Water Board regarding the proposed amendment to the ROD. The concurrence letter is in included in the Administrative Record.

List of Acronyms

1,1 DCA	1,1-dichloroethane
1,1 DCE	1,1-dichloroethene
1,1,1 TCA	1,1,1-trichloroethane
1,2 DCA	1,2-dichloroethane
ARAR	Applicable or Relevant and Appropriate Requirement
bgs	below ground surface
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
cis 1,2 DCE	cis-1,2-dichloroethene
ISCO	In-situ chemical oxidation
ISTD	In-situ thermal desorption
MCL	Maximum Contaminant Level
MNA	Monitored natural attenuation
NCP	National Contingency Plan
NPL	National Priorities List
O&M	Operation and Maintenance
ROD	Record of Decision
RSL	Regional Screening Level
RWQCB	Regional Water Quality Control Board
TCE	trichloroethene
trans 1,2 DCE	trans-1,2-dichloroethene
VOC	volatile organic compound


0
2000
4000 ft
237
101
LAWRENCE EXPRESSWAY
GREAT AMERICA PARKWAY
SCOTT BOULEVARD
CENTRAL EXPWAY
INTEL
SANTA CLARA 3
KIFER ROAD
BOWERS AVENUE
EXPWAY
WALSH AVENUE
SAN TOMAS
Pacific
Ocean
San
Francisco
SITE
N
SITE LOCATION MAP
Intel Santa Clara 3
Santa Clara, CA
By: MJC
JUNE 2007
Figure 1
STELLAR

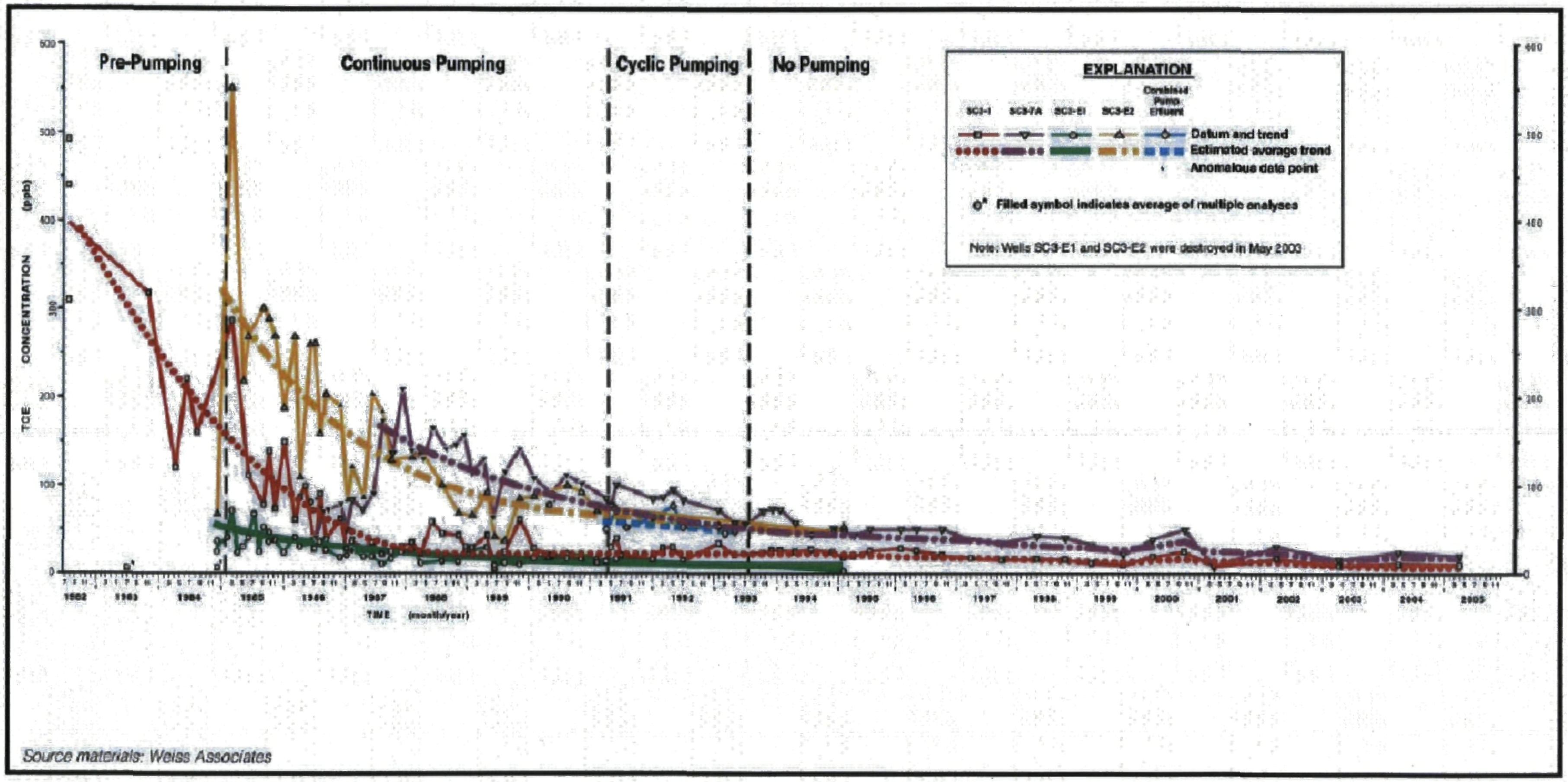
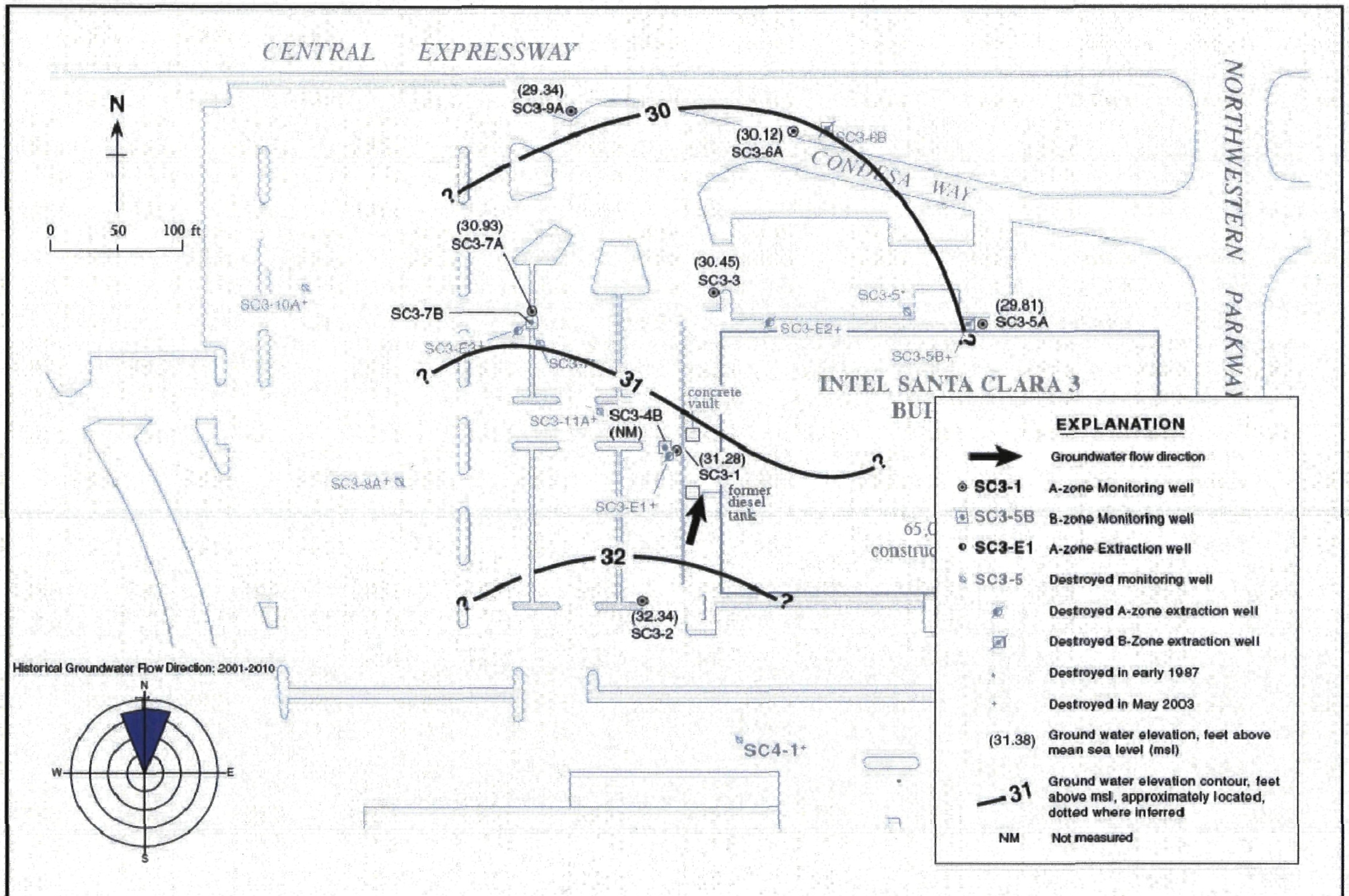


Figure 2: TCE concentrations in groundwater over time



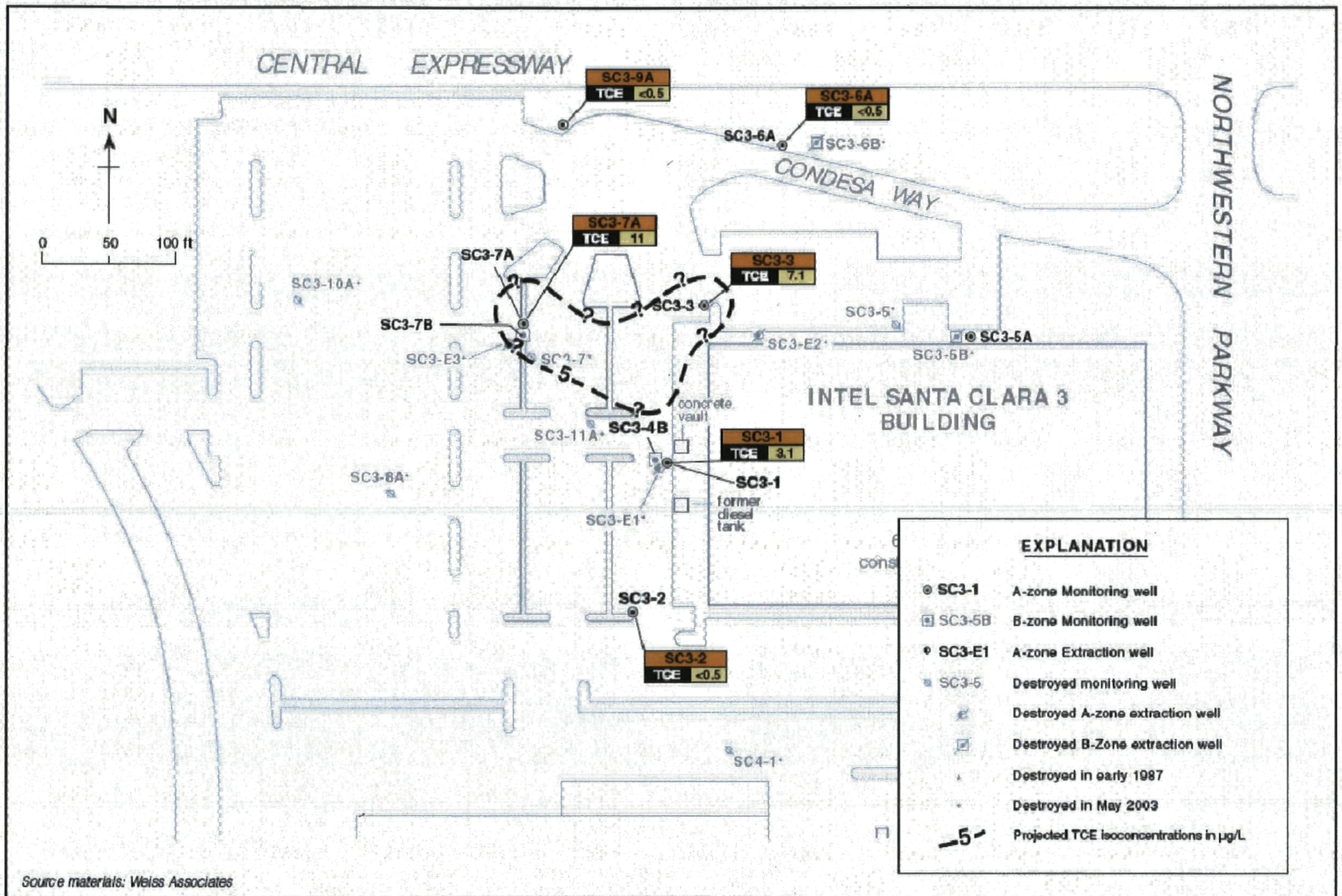
STELLAR ENVIRONMENTAL SOLUTIONS, INC
GEOSCIENCE & ENGINEERING CONSULTING

POTENTIOMETRIC SURFACE OF THE A WATER-BEARING ZONE
APRIL 19, 2010
Intel Santa Clara 3, Santa Clara, CA

Figure 3

by: MJC | MAY 2010

2007-01-11



STELLAR ENVIRONMENTAL SOLUTIONS, INC
GEOSCIENCE & ENGINEERING CONSULTING

DISTRIBUTION OF TCE IN THE A WATER-BEARING ZONE
APRIL 19, 2010
Intel Santa Clara 3, Santa Clara, CA

Figure 4

by: MJC | MAY 2010

Figure 5: TCE Concentrations in Intel Well SC3-1
April 2002 - April 2010, Santa Clara, CA

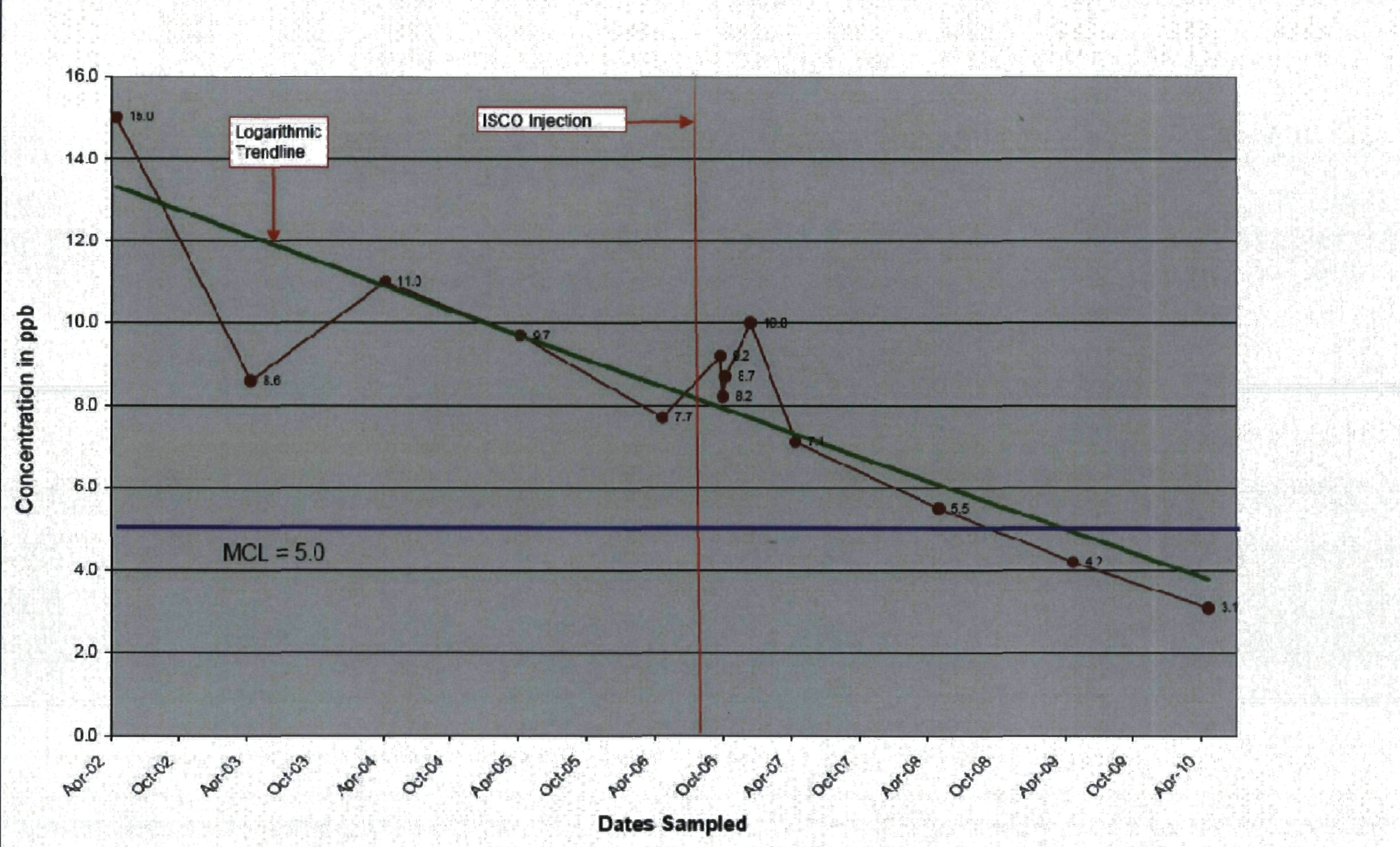


Figure 6: TCE Concentrations in Intel Well SC3-3
April 2002 - April 2010, Santa Clara, CA

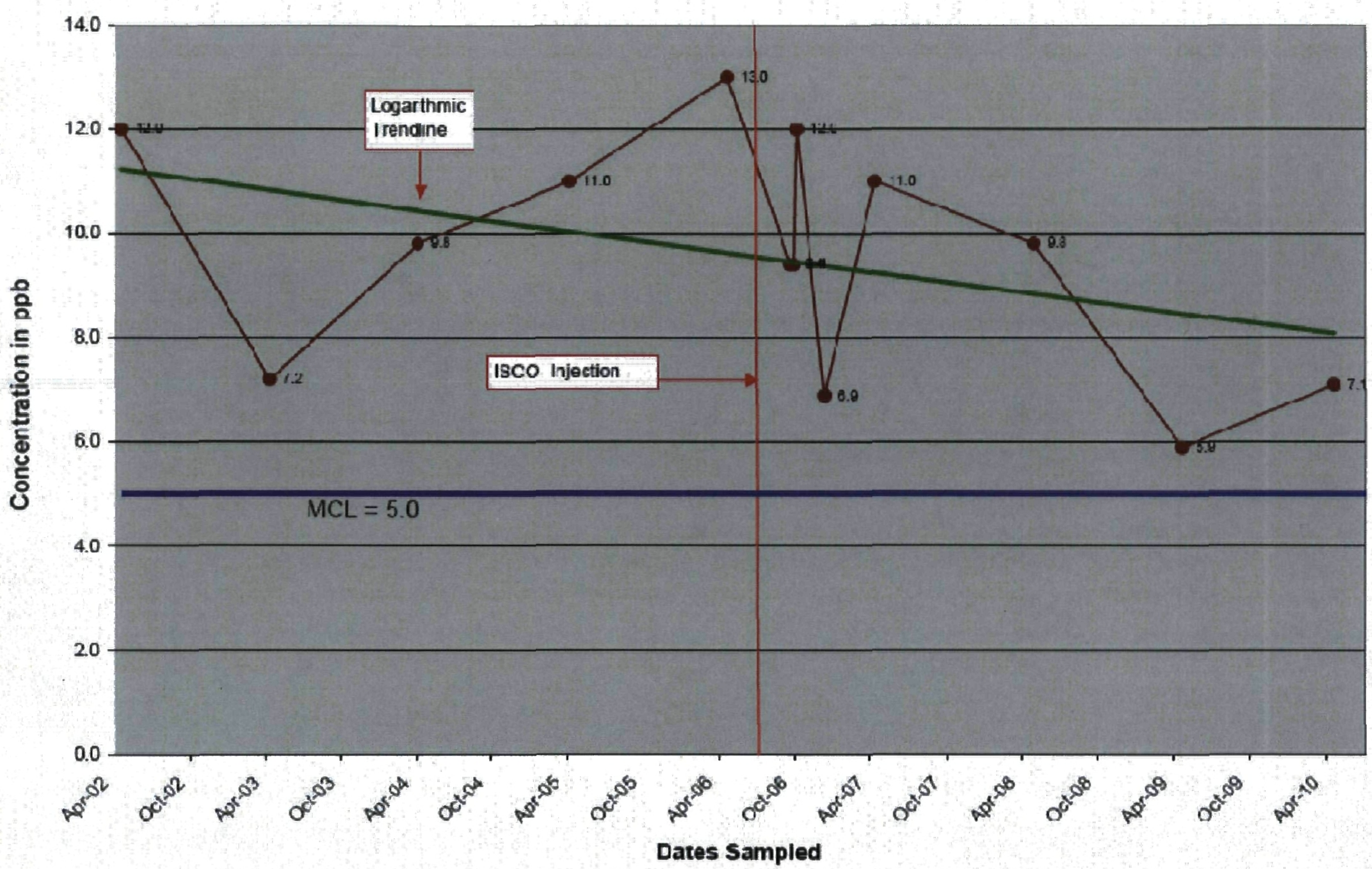


Figure 7: TCE Concentrations in Intel Well SC3-7A
April 2002 - April 2010, Santa Clara, CA

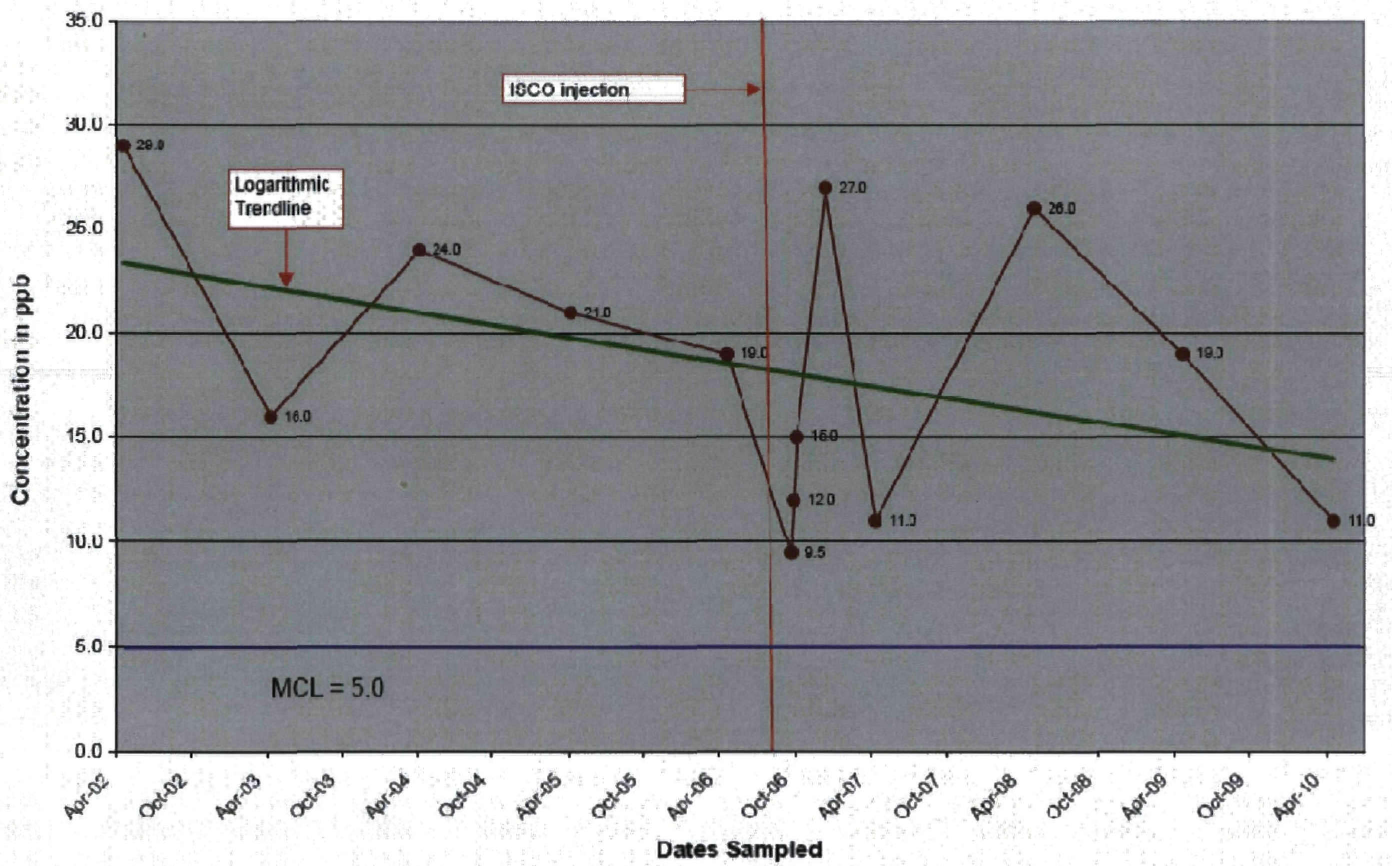


Figure 8: Nine Criteria Analysis (excluding State and Community Acceptance)

Evaluation Criteria	Alternative 1 No Action	Alternative 2 In-situ Bioremediation	Alternative 3 In-situ Thermal Desorption	Alternative 4 In-Situ Chemical Oxidation	Alternative 5 Monitored Natural Attenuation
Overall Protectiveness of Human Health and the Environment	●	●	●	●	●
Compliance with ARARs	○	●	●	●	●
Long-term Effectiveness and Permanence	—	◒	●	◒	●
Reduction of Toxicity, Mobility, or Volume through Treatment	—	●	●	●	○
Short-term Effectiveness	—	◒	◒	◒	●
Implementability	—	◒	○	◒	●
Capital Cost	—	$120,000	$280,000	$140,000	$0
Annual O&M Cost	—	$15,000	$15,000	$15,000	$20,000
Present Value Cost[1]	—	$290,000	$360,000	$300,000	$230,000

[1]Present Value Cost estimated over 30 years at 7% discount rate

○ = Does not meet criterion ◒ = Partially meets criterion ● = Meets criterion

The information in this cost estimate summary table is based on the best available information regarding the anticipated scope of the remedial alternative. Changes in the cost elements are likely to occur as a result of new information and data collected during the engineering design of the remedial alternative. Major changes may be documented in the form of a memorandum in the Administrative Record file, an ESD, or a ROD amendment. This is an order-of-magnitude engineering cost estimate that is expected to be within +50 to -30 percent of the actual project cost.